(a) (i) $(1 + x)^{-1} = 1 + (-1)x + px^2 + qx^3$

$p \neq 0$, $q \neq 0$

M1

$= 1 - x + x^2 - x^3$

SC 1/2 for $= 1 - x + px^2$

A1

2

(ii) $(1 + 3x)^{-1} = 1 - 3x + (3x)^2 - (3x)^3$

x replaced by $3x$ in candidate's (a)(i);condone missing brackets

M1

$= 1 - 3x + 9x^2 - 27x^3$

CAO SC x^3-term: $1 - 3x + \frac{3}{9}x^2$ 1/2

A1

2

Alt (starting again)

$(1 + 3x)^{-1} = 1 - (3x) + \frac{(-1)(-2)(3x)^2}{2!} + \frac{(-1)(-2)(-3)(3x)^3}{3!}$

condone missing brackets
accept 2 for 2!, 3.2 for 3!

(M1)

$= 1 - 3x + 9x^2 - 27x^3$

CAO

(A1)

(2)

(b) $\frac{1+4x}{(1+x)(1+3x)} = \frac{A}{1+x} + \frac{B}{1+3x}$

correct partial fractions form, and multiplication by denominator

M1

$1 + 4x = A(1 + 3x) + B(1 + x)$

$x = -1,\ x = -\frac{1}{3}$

Use (any) two values of x to find A and B

m1

$A = \frac{3}{2}, B = -\frac{1}{2}$

A and B both correct

A1 **3**

Alt:

$$\frac{1+4x}{(1+x)(1+3x)} = \frac{A}{1+x} + \frac{B}{1+3x}$$

correct partial fractions form, and multiplication by denominator

(M1)

$1 + 4x = A(1 + 3x) + B(1 + x)$

$A + B = 1, \quad 3A + B = 4$

Set up and solve

(m1)

$A = \frac{3}{2}, B = -\frac{1}{2}$

A and B both correct

(A1) **(3)**

(c) (i) $\frac{1+4x}{(1+x)(1+3x)} = \frac{3}{2(1+x)} - \frac{1}{2(1+3x)}$

M1

$= \frac{3}{2}(1 - x + x^2 - x^3) - \frac{1}{2}(1 - 3x + 9x^2 - 27x^3)$

multiply candidate's expansions by A and B, and expand and simplify

m1

$= 1 - 3x^2 + 12x^3$

CAO

SC A and B interchanged, treat as miscopy. ($1 - 4x + 13x^2 - 40x^3$)

A1 **3**

Alt

$$\frac{1+4x}{(1+x)(1+3x)} = (1+4x)(1+x)^{-1}(1+3x)^{-1}$$

$= (1 + 4x)(1 - x + x^2 - x^3)(1 - 3x + 9x^2 - 27x^3)$

write as product, using expansions condone missing brackets on (1 + 4x) only

(M1)

$= 1 - 4x + 13x^2 - 40x^3 + 4x - 16x^2 + 52x^3$

attempt to multiply the three expansions up to terms in x^3

(m1)

$= 1 - 3x^2 + 12x^3$

CAO

(A1)

(3)

(ii) $|x| < 1$ and $|3x| < 1$

OE and nothing else incorrect

M1

$|x| < \frac{1}{3}$ (0.33)

OE Condone ≤

A1

2

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